## GROUP 35C

# ACTIVE STABILITY CONTROL SYSTEM (ASC)

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# GENERAL

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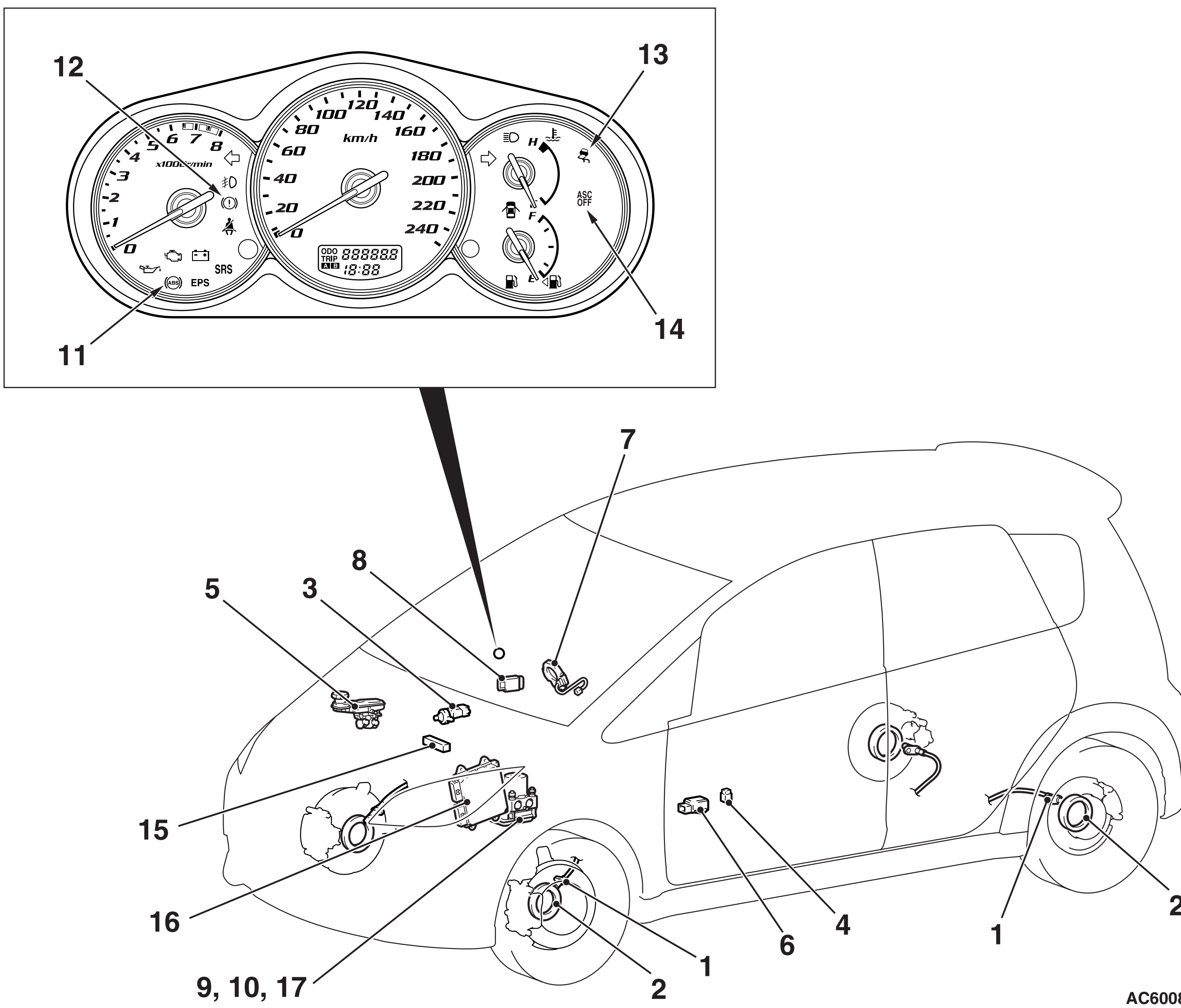
The active stability control system (ASC) has been installed to the M/T vehicle.

- The active stability control system (ASC) has the stability control and the traction control (TCL) functions. By the integrated control with the anti-lock brake system, the system stabilises the vehicle attitude and at the same time secures the driving force.
- When the stability control function determines that the vehicle is in a dangerous condition, it reduces the engine output and applies brake force to four wheels independently to control the vehicle behaviour, avoiding the critical state.
- The traction control (TCL) function prevents the driving wheel slip on a slippery road surface, ensuring easy startup, and at the same time, secures proper driving force and improves steering performance during cornering acceleration.
- Fail-safe function assures the security.
- Serviceability improvement
- For wiring harness saving and secure data communication, the CAN* communication has been adopted as a tool of communication with another ECU.

*NOTE:*

- **For more information about CAN (Controller Area Network), refer to GROUP 54C P.54C-2.*
- *ABS and ASC are controlled by ASC-ECU.*

## CONSTRUCTION DIAGRAM



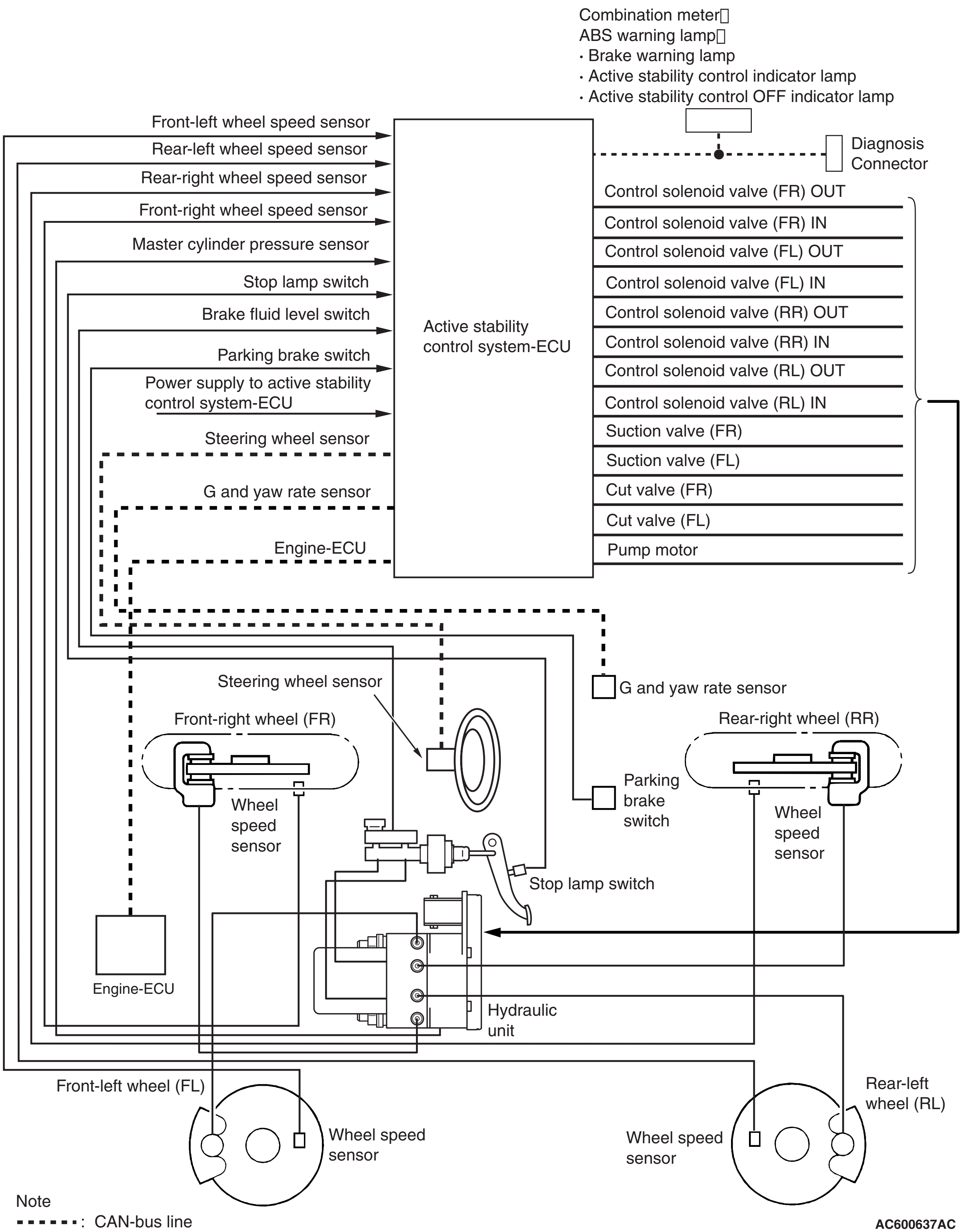

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| Component | | No. | Function |
|---|---|---|---|
| Sensor | Wheel speed sensor | 1 | Sends alternating current signals at frequencies which are proportional to the rotation speeds of each wheel to the active stability control system-ECU |
| | Magnetic encoder for wheel speed detection | 2 | The wheel speed sensor is a pulse generator. When the magnetic encoder for wheel speed detection (a plate on which north and south pole sides of the magnets are arranged alternately) rotates, it outputs frequency pulse signal in proportion to each wheel speed. |
| | Stop lamp switch | 3 | Sends a signal to the active stability control system-ECU to indicate whether the brake pedal is depressed or not. |
| | Parking brake switch | 4 | Outputs the signal indicating whether the parking brake lever is pulled or not to ASC-ECU. |
| | Brake fluid level switch | 5 | Outputs the signal indicating whether the brake fluid is filled to the lowest limit level or not to ASC-ECU. |
| | G and yaw rate sensor | 6 | Detects the lateral acceleration and the yaw rate for the vehicle. Then it sends a signal through the CAN bus line to the active stability control system-ECU. |
| | Steering wheel sensor | 7 | Detects the steering wheel angle, and sends a signal to the active stability control system-ECU through the CAN bus line. |
| | ASC OFF switch | 8 | Outputs the ASC ON/OFF signal to ASC-ECU. |
| | Pressure sensor | 9 | Is incorporated in the hydraulic unit, and informs the active stability control system-ECU of the brake fluid pressure in the master cylinder. |
| Actuator | Hydraulic unit | 10 | Drives the solenoid valves and pump motor according to signals from the ABS/active stability control system-ECU in order to control the brake hydraulic pressure for each wheel. |
| | ABS warning lamp | 11 | Illuminates in response to signals from the active stability control system-ECU when a problem develops in the system. |
| | Brake warning lamp | 12 | Illuminates in response to signals from the active stability control system-ECU when a problem develops in the EBD system or the brake fluid level is low. |
| | Active stability control system (ASC) indicator lamp | 13 | Receives a signal from the active stability control system-ECU, and flashes to inform the driver that the system is operating, or illuminates to inform the driver of system shutdown. |
| | ASC OFF indicator lamp | 14 | Informs the driver of the ASC shutdown by illuminating with the signal from ASC-ECU. |
| Diagnosis connector | | 15 | Sets the diagnosis codes and allows communication with the M.U.T.-III. |
| Engine-ECU | | 16 | Receives a signal from the active stability control system-ECU to control the engine output. |
| Anti-skid Brake/Active Stability Control System control unit (ABS/active stability control system-ECU) | | 17 | Controls actuators (described above) based on the signals coming from each sensor. |
| | | | Controls the self-diagnostics and fail-safe functions. |
| | | | Controls the diagnostic function (M.U.T.-III compatible). |

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## SCHEMATIC DIAGRAM



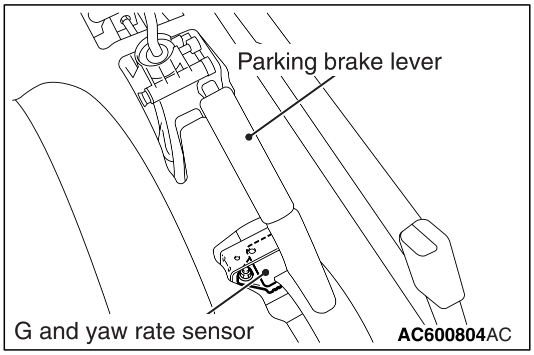
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# CONSTRUCTION DIAGRAM

## SENSOR

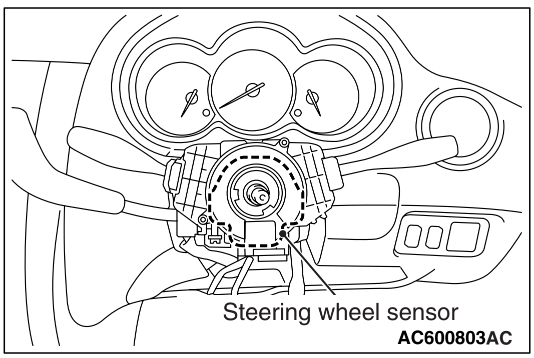
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### G AND YAW RATE SENSOR



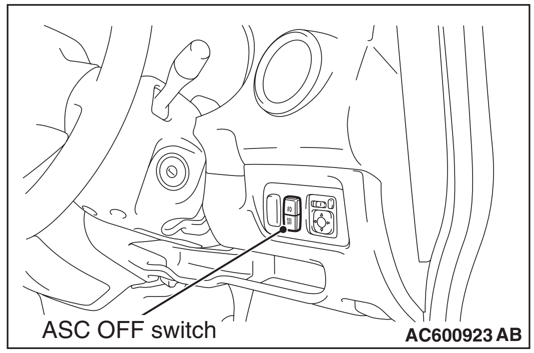

This sensor, installed under the centre console, detects the yaw rate and lateral acceleration of the vehicle.

### STEERING WHEEL SENSOR




This sensor, attached to the column switch, detects the rotational angle of the steering wheel.

## ASC OFF SWITCH




This switch is attached on the instrument panel to the right side of the driver's seat. The ASC system can be turned OFF by pressing this ASC OFF switch for 3 seconds when the ignition switch is ON. By pressing the switch again, the system can be turned ON.

*NOTE:*
- *When the ASC system is turned OFF, the ASC OFF indicator illuminates.*
- *If the ASC OFF switch is pressed for 15 seconds or more, the operational error prevention function activates, and the ASC system cannot be turned OFF until the ignition switch is turned to the ON position again.*

**ASC OFF switch operation and system operation**

| ASC OFF switch control | TCL function | Stability control function |
|---|---|---|
| ON (ASC OFF indicator goes out.) | Enabled | Enabled |
| OFF (ASC OFF indicator illuminates.) | Prohibited | Prohibited |

*NOTE: The ASC function starts the control when the vehicle speed is 10 km/h or more.*

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## ACTUATOR

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### HYDRAULIC UNIT

The hydraulic unit incorporates the ABS control and ASC control. The cut valve, pressure relief valve, suction valve, suction damper, and pressure sensor have been added to the unit for the ASC control.

*NOTE: For the internal hydraulic circuit of the hydraulic unit, refer to P.35C-17.*

## ASC INDICATOR LAMP, ASC OFF INDICATOR LAMP

The ASC system illuminates or flashes the ASC indicator lamp or ASC OFF indicator lamp in the following operation patterns, and informs the driver of the ASC system status.

**ASC indicator lamp**

- Flashes in 3 Hz interval during the stability control.
- Flashes in 3 Hz interval during the TCL control.
- Turns ON when the system malfunction occurs.

**ASC OFF indicator lamp**

- Illuminates when the ASC system is not activated.

**ASC indicator lamp, ASC OFF indicator lamp illumination and flashing patterns**

| State | | ASC indicator lamp | ASC OFF indicator lamp |
|---|---|---|---|
| Normal | Valve check | Illuminates for approx. 3 seconds after the ignition switch is turned ON. | Illuminates for approx. 3 seconds after the ignition switch is turned ON. |
| | Normal | – | – |
| | When the stability control is enabled | Flashing (3 Hz) | – |
| | TCL operated | Flashing (3 Hz) | – |
| | When the ASC control is turned OFF by the ASC OFF switch | – | Illuminates |
| Abnormal | Stability control malfunction | Illuminates | Illuminates |
| | TCL malfunction | Illuminates | Illuminates |
| M.U.T.-III connection | – | Illuminates | Illuminates |

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## ASC-ECU

M2357000100043

ABS-ECU and ASC-ECU are integrated in this ECU.

## SYSTEM CONFIGURATION

The hydraulic unit of the ASC system employs the automatic pressurisation function for stability and TCL control. The system also incorporates G and yaw rate sensor, steering wheel sensor, and pressure sensor (integrated with hydraulic unit).

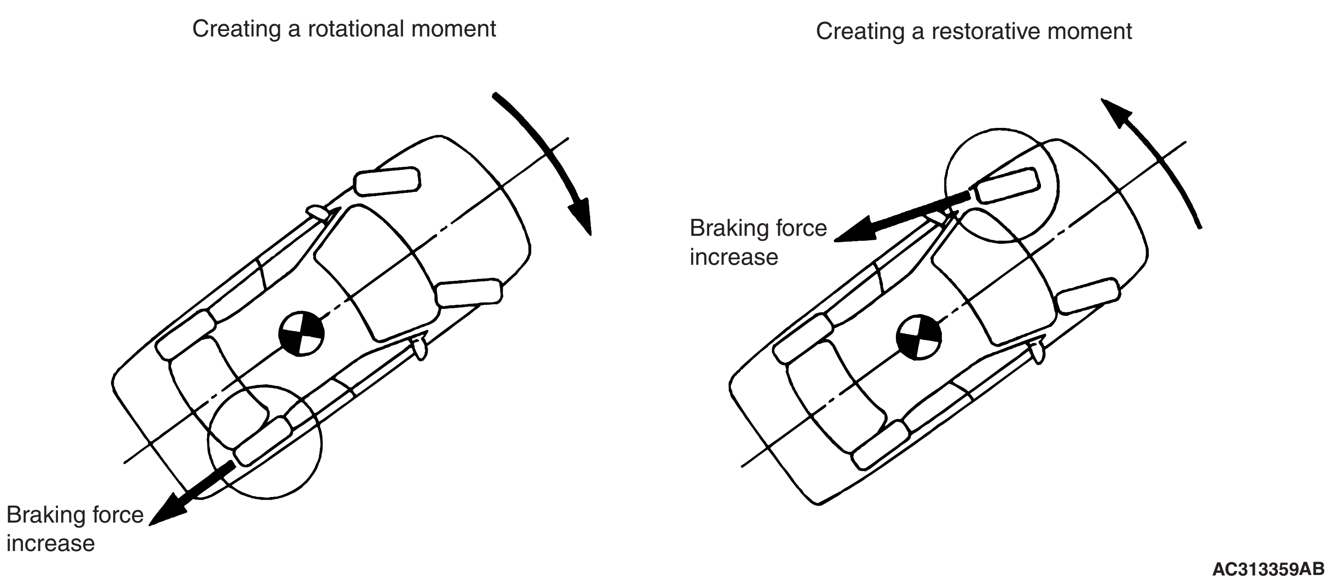
## CONTROL DESCRIPTION

ASC-ECU detects vehicle movement based on information from various sensors and calculates a model of ideal vehicle movement. ASC-ECU compares the actual vehicle movement with the ideal vehicle model, and manages the brake of the specific wheel so that the actual vehicle movement gets close to the ideal vehicle mode. It also controls the understeer or oversteer condition by creating the yaw moment (rotating direction force) in the vehicle.

### Stability control

The stability control manages the vehicle attitude by creating a yaw moment (rotating direction force) from altering the balance between the cornering force and each wheel's braking mechanism.

### Example of stability control operation

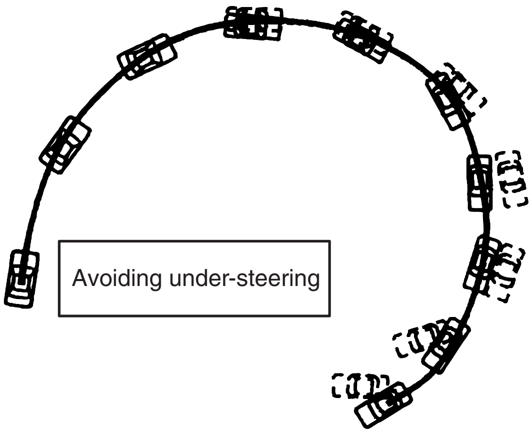



For example, on a slippery surface, if the vehicle tends to be under-steered contrary to the driver's intention, a yaw moment (a rotational moment) is created to restrain the under-steering by increasing the rear-inside braking force. On the other hand, when the vehicle tends to be oversteered, a yaw moment (a restorative moment) is created to restrain the oversteering by increasing the front-outside wheel braking force. Furthermore, when it is determined that the vehicle is over-speeding, safe and stable cornering is enabled by deceleration from reducing the engine output.

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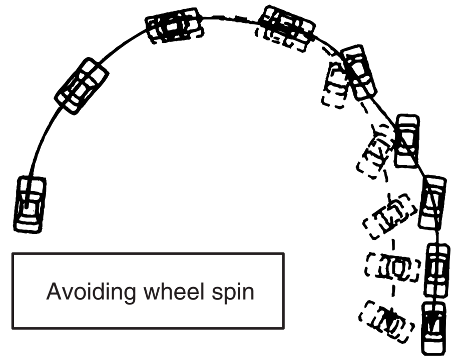
## EXAMPLE OF THE EFFECT OF CONTROL

Restraining under-steering



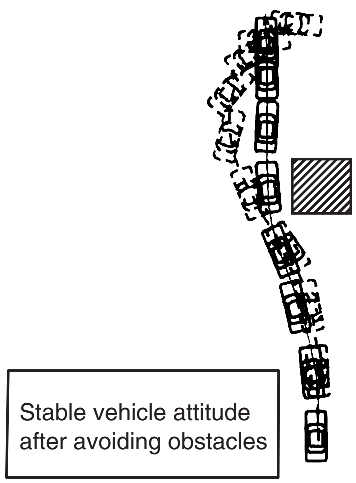

AC204505

Restraining over-steering




AC204506

Improving ABS performance




AC204504

AC204507AB

### Example of TCL control

When the driving wheel slips (ex. during driving on low μ road), TCL sends the engine output reduction signal to the engine ECU in order to prevent the driving force loss caused by the driving wheel slip. At the same time, TCL applies the brake to the slipping driving wheel so that the driving force is applied to the non-slipping driving wheel, which controls the slip of the driving wheel, securing the proper driving force and increased steering force.

### Fail-safe and diagnostic functions

ASC-ECU constantly monitors the input and output signals. If an error is detected in the system, ASC-ECU sends a fail signal and the corresponding indicator lamp is illuminated or blinks. Various controls are processed depending on the cause of malfunction as shown below. ASC-ECU has the following functions for easier system checks.

- Diagnosis code set
- Service data output
- Actuator test

All the above items can be diagnosed using M.U.T.-III.

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## FAIL-SAFE FUNCTION

| Diagnosis code No. | Item | ABS | EBD | TCL | | ASC | |
|---|---|---|---|---|---|---|---|
| | | | | Engine control | Brake control | Engine control | Brake control |
| C1200 | Wheel speed sensor (FR) system (open circuit or short to earth or power supply) | Prohibited | Enabled (Prohibited when three or more wheels have fault.) | Prohibited | Prohibited | Prohibited | Prohibited |
| C1205 | Wheel speed sensor (FL) system (open circuit or short to earth or power supply) | | | | | | |
| C1210 | Wheel speed sensor (RR) system (open circuit or short to earth or power supply) | | | | | | |
| C1215 | Wheel speed sensor (RL) system (open circuit or short to earth or power supply) | | | | | | |
| C1201 | Wheel speed sensor (FR) system (sensor output error) | Prohibited | Enabled (Prohibited when three or more wheels have fault.) | Prohibited | Prohibited | Prohibited | Prohibited |
| C1206 | Wheel speed sensor (FL) system (sensor output error) | | | | | | |
| C1211 | Wheel speed sensor (RR) system (sensor output error) | | | | | | |
| C1216 | Wheel speed sensor (RL) system (sensor output error) | | | | | | |
| C1222 | Wheel sensor system (abnormal power supply voltage) | Prohibited | Enabled (Prohibited when three or more wheels have fault.) | Prohibited | Prohibited | Prohibited | Prohibited |
| C1225 | Wheel speed sensor system (sensor output error) | Prohibited | Prohibited | Prohibited | Prohibited | Prohibited | Prohibited |

| Diagnosis code No. | Item | ABS | EBD | TCL | | ASC | |
|---|---|---|---|---|---|---|---|
| | | | | Engine control | Brake control | Engine control | Brake control |
| C1226 | Control solenoid valve (FR) pressure holding system | Prohibited | Prohibited | Prohibited | Prohibited | Prohibited | Prohibited |
| C1231 | Control solenoid valve (FR) decompressing system | | | | | | |
| C1236 | Control solenoid valve (FL) pressure holding system | | | | | | |
| C1241 | Control solenoid valve (FL) pressure reducing system | | | | | | |
| C1246 | Control solenoid valve (RR) pressure holding system | | | | | | |
| C1251 | Control solenoid valve (RR) pressure reducing system | | | | | | |
| C1256 | Control solenoid valve (RL) pressure holding system | | | | | | |
| C1261 | Control solenoid valve (RL) decompressing system | | | | | | |
| C1266 | Motor system (seizure) | Prohibited | Back-up control | Prohibited | Prohibited | Prohibited | Prohibited |
| C1273 | Motor relay stuck OFF | | | | | | |
| C1274 | Motor relay stuck ON | | | | | | |
| C1276 | Valve relay system | Enabled | Enabled | Enabled | Enabled | Prohibited | Prohibited |
| C1278 | Valve relay system stuck off | Enabled | Enabled | Enabled | Enabled | Prohibited | Prohibited |
| C1279 | Valve relay system stuck on | Prohibited | Enabled | Prohibited | Prohibited | Prohibited | Prohibited |
| C1300 | Cut valve (FR/RL) <primary> system | Prohibited | Prohibited | Prohibited | Prohibited | Prohibited | Prohibited |
| C1305 | Suction valve (FR/RL) <primary> system | | | | | | |
| C1310 | Cut valve (FL/RR) <secondary> system | | | | | | |
| C1315 | Suction valve (FL/RR) <secondary> system | | | | | | |
| C1340 | Stop lamp switch signal error | Enabled | Enabled | Prohibited | Prohibited | Prohibited | Prohibited |
| C1345 | Low brake fluid level | Enabled | Enabled | Enabled | Enabled | Enabled | Enabled |
| C1364 | Internal malfunction of pressure sensor | Prohibited | Enabled | Prohibited | Prohibited | Prohibited | Prohibited |
| C1366 | Lateral G-sensor signal error | Enabled | Enabled | Prohibited | Prohibited | Prohibited | Prohibited |

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| Diagnosis code No. | Item | ABS | EBD | TCL | | ASC | |
|---|---|---|---|---|---|---|---|
| | | | | Engine control | Brake control | Engine control | Brake control |
| C1371 | Yaw rate sensor signal error | Enabled | Enabled | Prohibited | Prohibited | Prohibited | Prohibited |
| C1385 | Yaw rate sensor error | | | | | | |
| C1387 | Lateral G-sensor error | Enabled | Enabled | Prohibited | Prohibited | Prohibited | Prohibited |
| C1388 | Yaw rate sensor active check error | Enabled | Enabled | Prohibited | Prohibited | Prohibited | Enabled |
| C1394 | Steering wheel sensor neutral point not learned | Enabled | Enabled | Prohibited | Prohibited | Prohibited | Prohibited |
| C1396 | Engine torque intervention rejection | Enabled | Enabled | Prohibited | Prohibited | Prohibited | Prohibited |
| C1505 | Steering wheel sensor malfunction (detection at the ASC-ECU side) | Enabled | Enabled | Prohibited | Prohibited | Prohibited | Prohibited |
| C1555 | Range exceeding of steering wheel sensor | | | | | | |
| C1607 | Malfunction of ASC-ECU | Prohibited | Prohibited | Prohibited | Prohibited | Prohibited | Prohibited |
| | ASC-ECU malfunction (CAN communication circuit failure) | Enabled | Enabled | Prohibited | Prohibited | Prohibited | Prohibited |
| C1621 | G and yaw rate sensor improper installation | Enabled | Enabled | Prohibited | Prohibited | Prohibited | Prohibited |
| C1860 | Abnormal rise of ASC-ECU power supply voltage | Prohibited | Prohibited | Prohibited | Prohibited | Prohibited | Prohibited |
| C1861 | Abnormal drop of ASC-ECU power supply voltage | Prohibited | Enabled | Prohibited | Prohibited | Prohibited | Prohibited |
| C1862 | Abnormal power supply voltage of G and yaw rate sensor (high voltage) | Enabled | Enabled | Prohibited | Prohibited | Prohibited | Prohibited |
| C1863 | Abnormal power supply voltage of G and yaw rate sensor (low voltage) | | | | | | |
| U1073 | Bus-off | Enabled | Enabled | Prohibited | Prohibited | Prohibited | Prohibited |
| U1100 | Engine-related CAN time-out error | Enabled | Enabled | Prohibited | Prohibited | Prohibited | Prohibited |
| U1104 | Steering wheel sensor CAN time-out error | Enabled | Enabled | Prohibited | Prohibited | Prohibited | Prohibited |
| U1105 | G and yaw rate sensor CAN time-out error | Enabled | Enabled | Prohibited | Prohibited | Prohibited | Prohibited |
| U1406 | Accelerator pedal position signal error | Enabled | Enabled | Prohibited | Prohibited | Prohibited | Prohibited |
| U1426 | Engine speed signal error | Enabled | Enabled | Prohibited | Prohibited | Prohibited | Prohibited |
| U1427 | Engine torque signal error | Enabled | Enabled | Prohibited | Prohibited | Prohibited | Prohibited |

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| Diagnosis code No. | Item | ABS | EBD | TCL | | ASC | |
|---|---|---|---|---|---|---|---|
| | | | | Engine control | Brake control | Engine control | Brake control |
| U1428 | Engine's maximum torque signal error | Enabled | Enabled | Prohibited | Prohibited | Prohibited | Prohibited |
| U1429 | Engine's minimum torque signal error | Enabled | Enabled | Prohibited | Prohibited | Prohibited | Prohibited |
| U1430 | Engine torque request signal error | Enabled | Enabled | Prohibited | Prohibited | Prohibited | Prohibited |

## Indicator lamp

| Diagnosis code No. | Item | Brake warning lamp | ABS warning lamp | Active stability control system (ASC) indicator lamp | ASC OFF indicator lamp |
|---|---|---|---|---|---|
| C1200 | Wheel speed sensor (FR) system (open or short to earth or power supply) | Illuminates when three wheels or more are abnormal. | Illuminates | Illuminates | Illuminates |
| C1205 | Wheel speed sensor (FL) system (open or short to earth or power supply) | | | | |
| C1210 | Wheel speed sensor (RR) system (open or short to earth or power supply) | | | | |
| C1215 | Wheel speed sensor (RL) system (open or short to earth or power supply) | | | | |
| C1201 | Wheel speed sensor (FR) system (sensor transmitting error) | Illuminates when three wheels or more are abnormal. | Illuminates | Illuminates | Illuminates |
| C1206 | Wheel speed sensor (FL) system (sensor transmitting error) | | | | |
| C1211 | Wheel speed sensor (RR) system (sensor transmitting error) | | | | |
| C1216 | Wheel speed sensor (RL) system (sensor transmitting error) | | | | |
| C1222 | Wheel sensor system (abnormal power supply voltage) | Illuminate | Illuminate | Illuminate | Illuminate |
| C1225 | Wheel speed sensor malfunction | Illuminates | Illuminates | Illuminates | Illuminates |

| Diagnosis code No. | Item | Brake warning lamp | ABS warning lamp | Active stability control system (ASC) indicator lamp | ASC OFF indicator lamp |
|---|---|---|---|---|---|
| C1226 | Control solenoid valve (FR) pressure holding system | Illuminates | Illuminates | Illuminates | Illuminates |
| C1231 | Control solenoid valve (FR) decompressing system | | | | |
| C1236 | Control solenoid valve (FL) pressure holding system | | | | |
| C1241 | Control solenoid valve (FL) pressure reducing system | | | | |
| C1246 | Control solenoid valve (RR) pressure holding system | | | | |
| C1251 | Control solenoid valve (RR) pressure reducing system | | | | |
| C1256 | Control solenoid valve (RL) pressure holding system | | | | |
| C1261 | Control solenoid valve (RL) decompressing system | | | | |
| C1266 | Pump motor rotation malfunction | Off | Illuminates | Illuminates | Illuminates |
| C1273 | Pump motor drive circuit malfunction | | | | |
| C1274 | Pump motor drive circuit stuck on | | | | |
| C1276 | Valve relay system | Illuminates | Illuminates | Illuminates | Illuminates |
| C1278 | Valve relay stuck off | | | | |
| C1279 | Valve relay stuck on | Illuminates | Illuminates | Illuminates | Illuminates |
| C1300 | Front-right cut valve (Primary) | Illuminates | Illuminates | Illuminates | Illuminates |
| C1305 | Front-right suction valve (Primary) | | | | |
| C1310 | Front-left cut valve (secondly) | | | | |
| C1315 | Front-left suction valve (secondly) | | | | |
| C1340 | Abnormal stop lamp switch signal | Off | Illuminates | Illuminates | Illuminates |
| C1345 | Low brake fluid level | Illuminates | Off | Off | Off |

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| Diagnosis code No. | Item | Brake warning lamp | ABS warning lamp | Active stability control system (ASC) indicator lamp | ASC OFF indicator lamp |
|---|---|---|---|---|---|
| C1364 | Brake fluid Pressure sensor malfunction | Off | Illuminates | Illuminates | Illuminates |
| C1366 | Lateral G sensor signal malfunction | Off | Off | Illuminates | Illuminates |
| C1371 | Yaw rate sensor signal malfunction | Off | Off | Illuminates | Illuminates |
| C1385 | Yaw rate sensor malfunction | | | | |
| C1387 | Lateral G-sensor malfunction | Off | Off | Illuminates | Illuminates |
| C1388 | Yaw rate sensor active check error | | | | |
| C1394 | Steering wheel sensor neutral point not learned | Off | Off | Illuminates | Illuminates |
| C1396 | Active stability control system control temporarily disabled (engine torque request rejected) | Off | Off | Illuminates | Illuminates |
| C1505 | Steering wheel sensor abnormality (detected at ABS/active stability control system-ECU-side) | Off | Off | Illuminates | Illuminates |
| C1555 | Output error in steering wheel sensor | | | | |
| C1607 | Defective active stability control system-ECU | Illuminates | Illuminates | Illuminates | Illuminates |
| C1621 | G and yaw rate sensor improper installation | Off | Off | Illuminate | Illuminate |
| C1860 | ABS/Active stability control system-ECU power supply voltage malfunction (high voltage) | Illuminates | Illuminates | Illuminates | Illuminates |
| C1861 | ABS/Active stability control system-ECU power supply voltage malfunction (low voltage) | Illuminates | Illuminates | Illuminates | Illuminates |
| C1862 | G and yaw rate sensor power supply voltage malfunction (high voltage) | Off | Off | Illuminates | Illuminates |

| Diagnosis code No. | Item | Brake warning lamp | ABS warning lamp | Active stability control system (ASC) indicator lamp | ASC OFF indicator lamp |
|---|---|---|---|---|---|
| C1863 | G and yaw rate sensor power supply voltage malfunction (low voltage) | Off | Off | Illuminates | Illuminates |
| U1073 | Bus-off | Illuminates | Illuminates | Illuminates | Illuminates |
| U1100 | Engine-related CAN Timeout error | Off | Off | Illuminates | Illuminates |
| U1104 | Steering wheel sensor CAN Timeout error | Off | Off | Illuminates | Illuminates |
| U1105 | G and yaw rate sensor time-out | Off | Off | Illuminates | Illuminates |
| U1406 | Failure information on engine-A-M/T-ECU (related to engine) | Off | Off | Illuminates | Illuminates |
| U1426 | Failure information on engine-A-M/T-ECU (related to engine) | Off | Off | Illuminates | Illuminates |
| U1427 | Failure information on engine-A-M/T-ECU (related to engine) | | | | |
| U1428 | Failure information on engine-A-M/T-ECU (related to engine) | | | | |
| U1429 | Failure information on engine-A-M/T-ECU (related to engine) | | | | |
| U1430 | Failure information on engine-A-M/T-ECU (related to engine) | | | | |

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## DIAGNOSIS CODE READING METHOD

There are 55 diagnosis items. The diagnosis code can be checked using M.U.T.-III.

## HOW TO ERASE DIAGNOSIS CODE MEMORY

Diagnosis code can be erased using M.U.T.-III.

### Data list output

The following items input to ASC-ECU can be read using M.U.T.-III.

*NOTE: For service data items, refer to Workshop Manual.*

### Actuator test

By forcibly operating the actuator using M.U.T.-III, the following operations can be performed.

- Forced ABS activation for each wheel
- Forced TCL (brake control) activation for each wheel
- Forced TCL (engine control) activation

*NOTE:*

- *When ASC-ECU is disabled, the actuator test cannot be performed.*
- *M.U.T.-III uses the ABS data list.*
- *For the actuator test specification, refer to Workshop Manual.*

## CALIBRATION

When the following operations are performed, the steering wheel sensor needs to be calibrated using the M.U.T.-III*.

- Front wheel alignment adjustment
- Steering wheel sensor replacement

*NOTE:*

- *M.U.T.-III uses the ABS data list.*
- **: For calibration, refer to Workshop Manual.*

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# DESCRIPTION OF CONSTRUCTION AND OPERATION

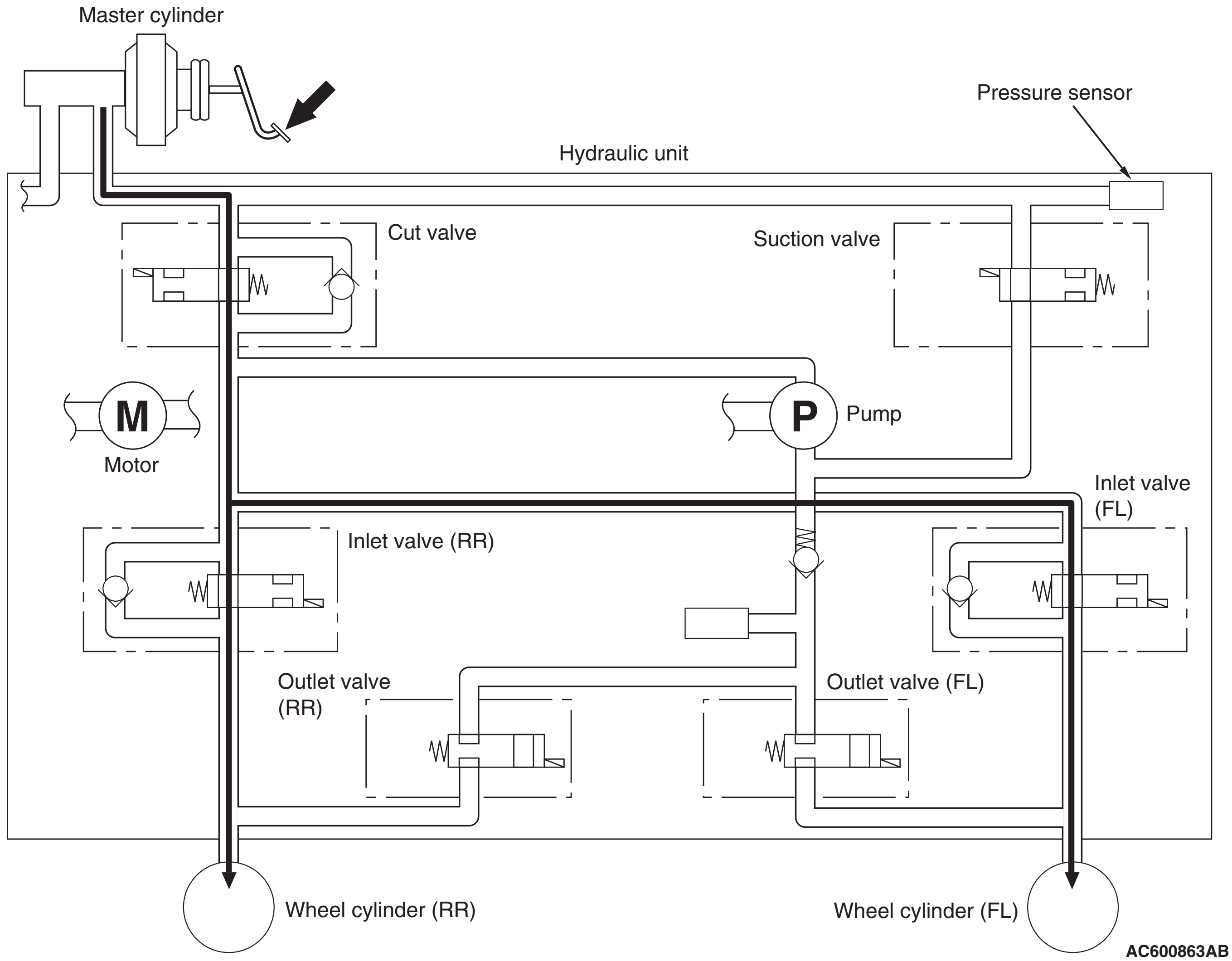
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## Stability control operation

- ASC-ECU receives various kinds of information from the wheel speed sensor, steering wheel sensor, G and yaw rate sensor, pressure sensor, stop lamp switch, brake fluid level switch, parking brake switch, and engine ECU. When ECU determines the vehicle runs in the oversteer or understeer direction based on the signal sent from these sensors, ASC-ECU drives each valve and pump motor and controls the braking force to be applied to the wheels.
- When the system increases the fluid pressure automatically, it closes the cut valve to shut off the pressure line to the suction valve, and drives the pump motor. For example, when the vehicle runs in the oversteer direction while turning to the right, ASC-ECU supplies the brake fluid from the pump to the front left wheel in order to apply the braking force on it.
- ASC-ECU and the engine ECU communicate with each other via CAN communication. When the accelerator pedal is depressed too far, the signal requesting the engine output reduction is sent to the engine ECU so that the ASC controllability can be secured.

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### When the brake fluid pressure is increased at ABS deactivation (normal brake control)/ABS activation (Example: When the front-left/rear-right wheel system pressure is increased)



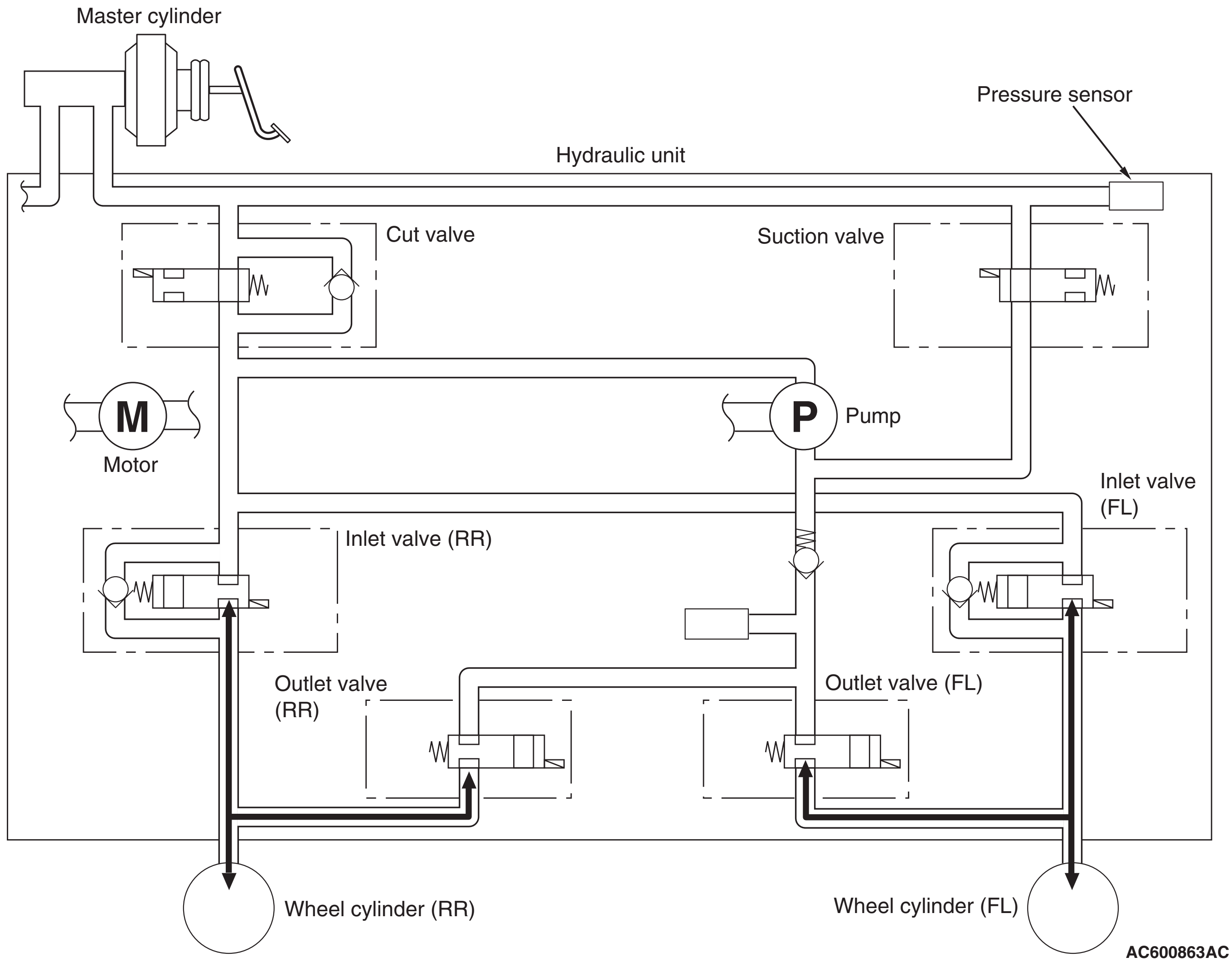

The fluid pressure generated from the master cylinder is supplied to each wheel cylinder through the cut valve and outlet valve (FL/RR).

**VALVE CONDITION**

| Item | Power status | Open/Close |
|---|---|---|
| Suction valve | OFF | Closed |
| Cut valve | OFF | Open |
| Inlet valve (FL) | OFF | Open |
| Inlet valve (RR) | OFF | Open |
| Outlet valve (FL) | OFF | Closed |
| Outlet valve (RR) | OFF | Closed |

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### When the brake fluid pressure is held by the ABS control/stability control (Example: When the front-left/rear-right wheel system pressure is held)

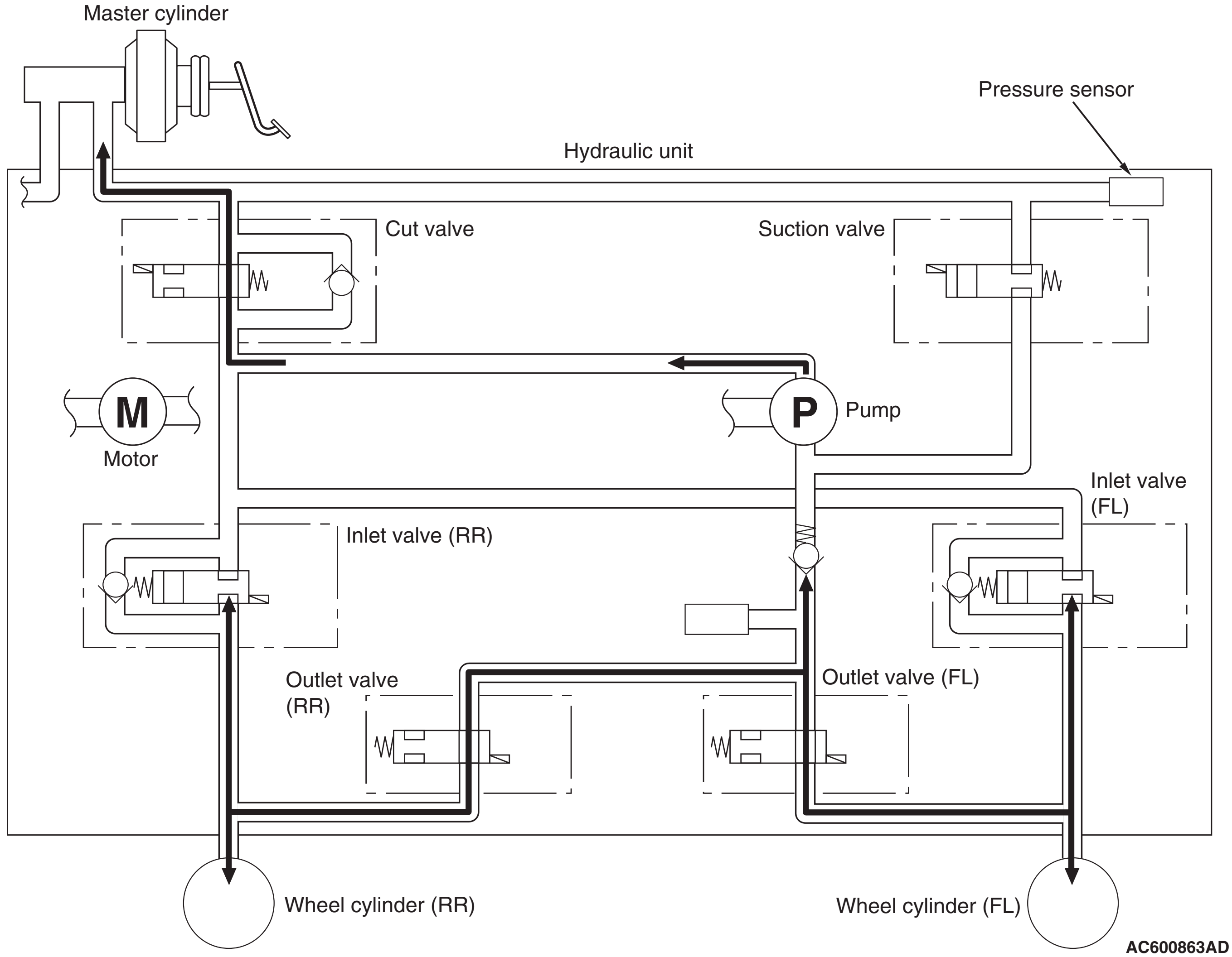



By closing the inlet valve (FL/RR) and outlet valve (FL/RR), the brake fluid pressure in the wheel cylinder can be maintained.

#### VALVE CONDITION

| Item | Power status | Open/Close |
|---|---|---|
| Suction valve | OFF | Closed |
| Cut valve | OFF | Open |
| Inlet valve (FL) | ON | Closed |
| Inlet valve (RR) | ON | Closed |
| Outlet valve (FL) | OFF | Closed |
| Outlet valve (RR) | OFF | Closed |

## When the brake fluid pressure is reduced by the ABS control/stability control (Example: Front-left/rear-right wheel system)



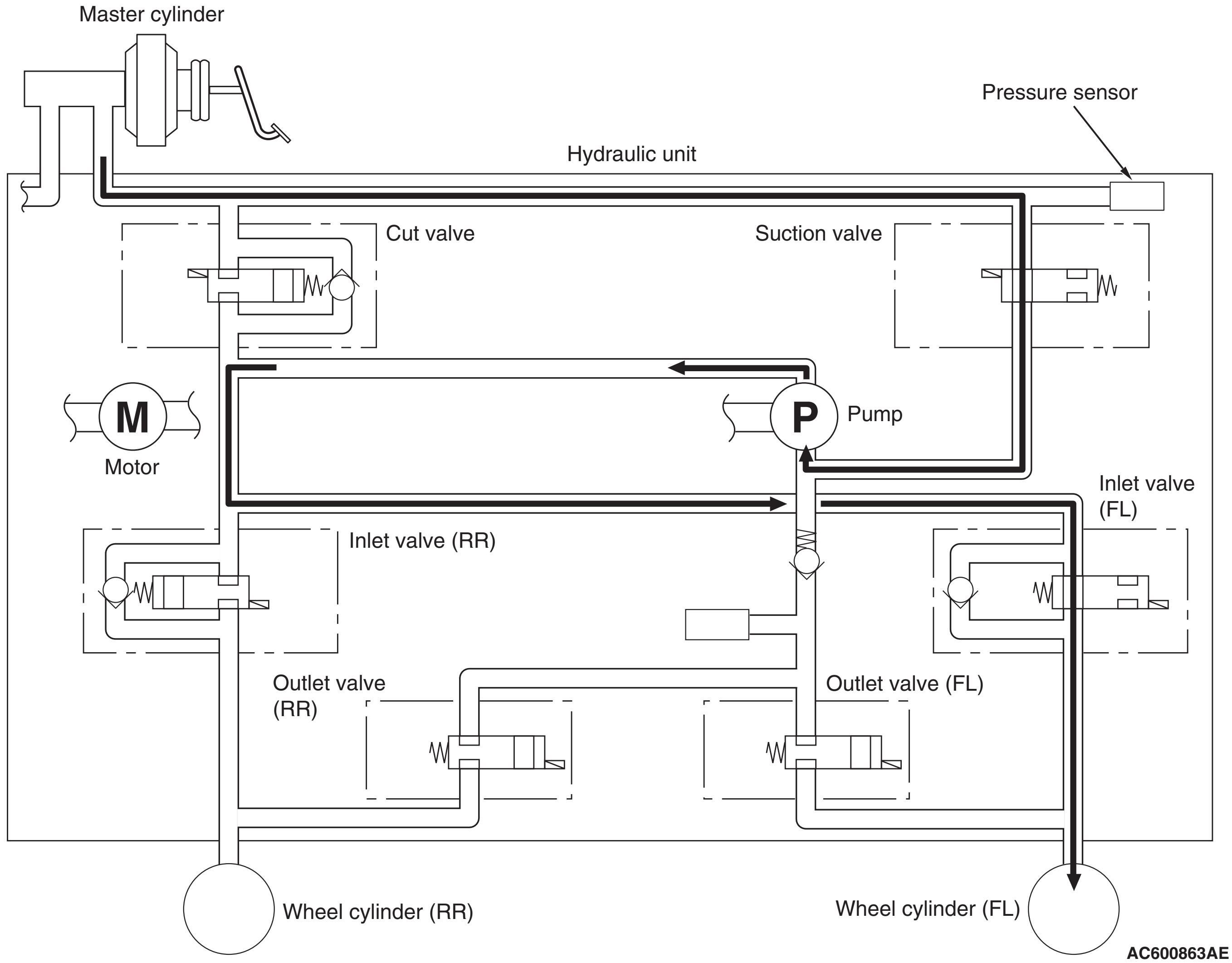

The outlet valve (FL/RR) is opened to drive the pump, and the brake fluid in the wheel cylinder is returned to the master cylinder so that the fluid level in the wheel cylinder is reduced.

### VALVE CONDITION

| Item | Power status | Open/Close |
|---|---|---|
| Suction valve | OFF | Closed |
| Cut valve | OFF | Open |
| Inlet valve (FL) | ON | Closed |
| Inlet valve (RR) | ON | Closed |
| Outlet valve (FL) | ON | Open |
| Outlet valve (RR) | ON | Open |

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## When the brake fluid pressure is increased by the TCL control/stability control (Example: When the front-left wheel system pressure is increased)



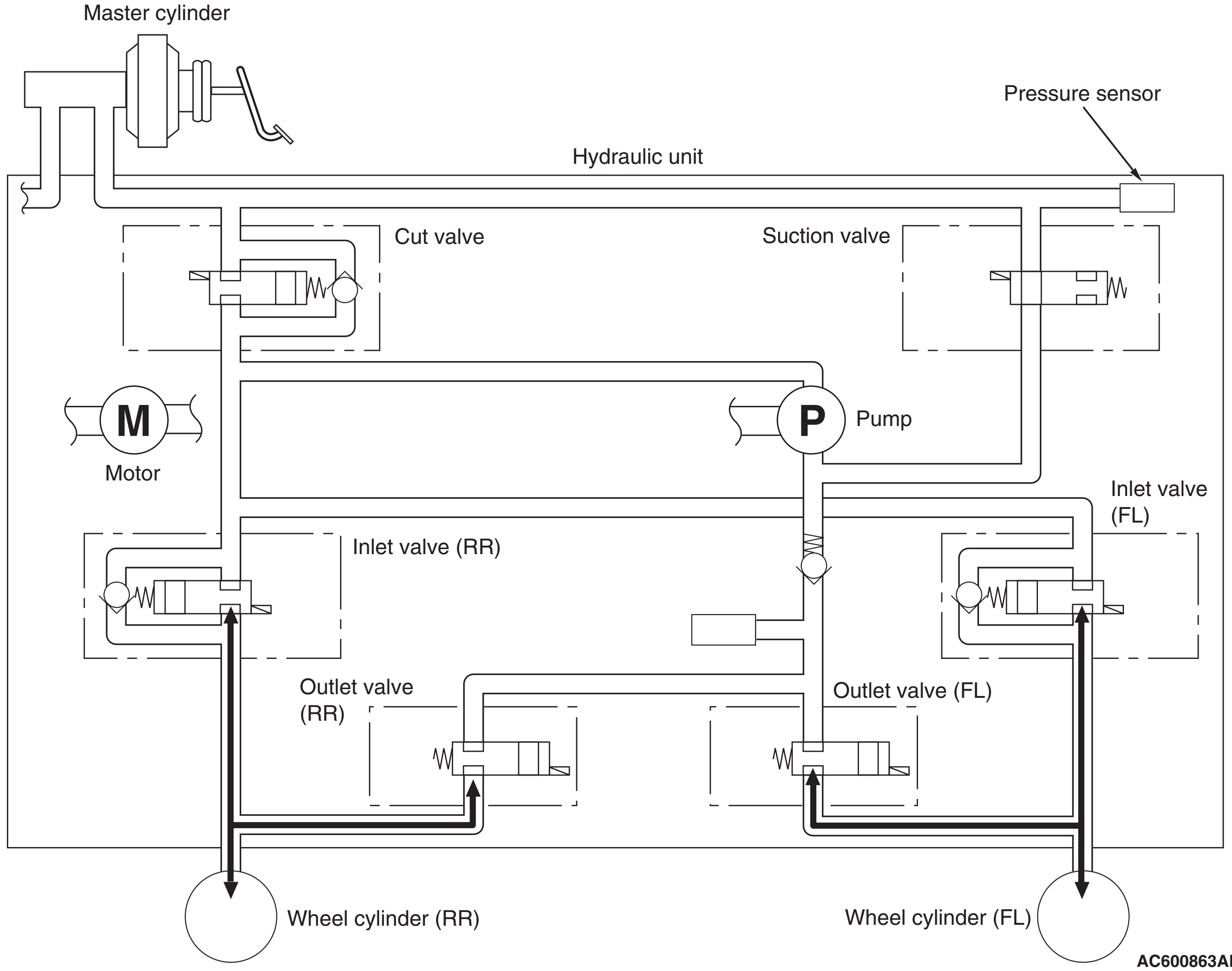

The inlet valve (RR) is closed to prevent the brake fluid pressure from being applied to the wheel cylinder (RR). The suction valve and inlet valve (FL) are opened to drive the pump, which supplies the brake fluid from the master cylinder to the wheel cylinder (FL).

### VALVE CONDITION

| Item | Power status | Open/Close |
|---|---|---|
| Suction valve | ON | Open |
| Cut valve | ON | Closed |
| Inlet valve (FL) | OFF | Open |
| Inlet valve (RR) | ON | Closed |
| Outlet valve (FL) | OFF | Closed |
| Outlet valve (RR) | OFF | Closed |

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## When the brake fluid pressure is held by the TCL control/stability control (Example: When the front-left/rear-right wheel system pressure is held)



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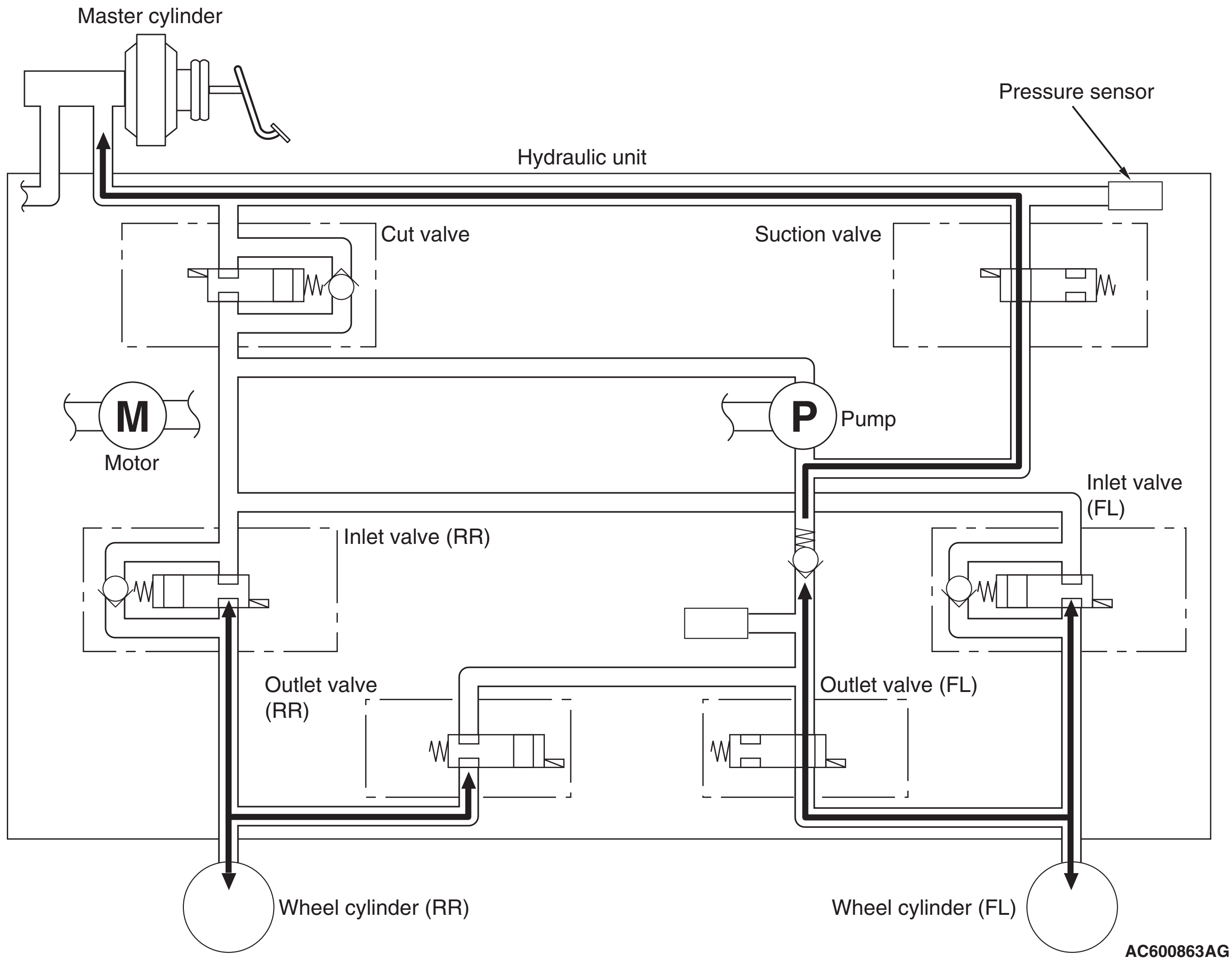
By closing the inlet valve (FL/RR) and outlet valve (FL/RR), the brake fluid pressure in the wheel cylinder can be maintained.

### VALVE CONDITION

| Item | Power status | Open/Close |
|---|---|---|
| Suction valve | ON | Open |
| Cut valve | ON | Closed |
| Inlet valve (FL) | ON | Closed |
| Inlet valve (RR) | ON | Closed |
| Outlet valve (FL) | OFF | Closed |
| Outlet valve (RR) | OFF | Closed |

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## When the brake fluid pressure is reduced by the TCL control/stability control (Example: When the front-left wheel system pressure is reduced/rear-right is held)




By opening the outlet valve (FL), the fluid pressure applied to the wheel cylinder (FL) is returned to the master cylinder through the suction valve, reducing the brake fluid pressure in the wheel cylinder (FL). The brake fluid pressure in the wheel cylinder (RR) can be held by keeping the inlet valve (RR) and outlet valve (RR) closed.

### VALVE CONDITION

| Item | Power status | Open/Close |
|---|---|---|
| Suction valve | ON | Open |
| Cut valve | ON | Closed |
| Inlet valve (FL) | ON | Closed |
| Inlet valve (RR) | ON | Closed |
| Outlet valve (FL) | ON | Open |
| Outlet valve (RR) | OFF | Closed |

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## Traction control operation

ASC-ECU receives various kinds of information from the engine ECU, steering wheel sensor, G and yaw rate sensor, and wheel speed sensor. When ASC-ECU determines that the driving wheel is slipping, it suppresses the wheel slippage. At this time, ASC-ECU controls the brake fluid pressure of the driving wheel determined to be slipping so that the torque is transferred to another driving wheel. The operations of suction valve, cut valve, and solenoid valve are basically the same as that of the stability control. ASC-ECU and the engine ECU communicate with each other via CAN bus line. When the accelerator pedal is depressed too far, the signal requesting the engine output reduction is sent to the engine ECU so that the TCL controllability can be secured.